Section 5
Noise

PATRIOT RENEWABLES
Spruce Mountain Wind, LLC

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5.0 NOISE

Tetra Tech has completed an acoustic assessment for the proposed Spruce Mountain Wind Project (Project) to determine sound levels resulting from the Project. Both operational and construction noise levels have been calculated and assessed. The overall objectives of this study were to: (1) quantify project sound sources and site-specific sound propagation characteristics; (2) model, using computer software, future wind turbine generator sound levels over a range of operational and meteorological conditions; and (3) determine the feasibility of the Project to operate in compliance with the applicable regulatory standards.

5.1 Acoustic Terminology and Definitions

All sounds originate with a source, whether it is a human voice, motor vehicles on a roadway, or a wind turbine. Sound energy propagates through a medium where it is sensed and then interpreted by a receiver. A sound source is defined by a sound power level (L_w), which is independent of any external factors. By definition, sound power is the rate at which acoustical energy is radiated outward and is expressed in units of watts (W). Sound energy travels in the form of a wave, a rapid fluctuation or oscillation of air pressure above and below atmospheric pressure. A sound pressure level (L_P) is a measure of this fluctuation at a given receiver location and can be obtained through the use of a microphone or calculated from information about the source sound power level and the surrounding environment. A source sound power level cannot be measured directly; it is calculated from measurements of sound intensity or sound pressure at a given distance from the source outside the acoustic and geometric near-field.

Sound pressure levels are described on a logarithmic scale to account for the large range of pressure that the human ear can perceive and is expressed in units of decibels (dB). A decibel is defined as the ratio between a measured value and a reference value usually corresponding to the lower threshold of human hearing defined as 20 micropascals (μPa). Conversely, sound power is referenced to 1 picowatt (pW). Broadband sound includes sound energy summed across the frequency spectrum. In addition to broadband sound pressure levels, an acoustic assessment may also include the analysis of the various frequency components of the sound spectrum to determine tonal characteristics or low frequency noise components. The unit of frequency is Hertz (Hz), which measures the cycles per second of the sound pressure waves. Typically, the frequency analysis examines 11 octave (or 1/3 octave) bands from 16 Hz (low) to 16,000 Hz (high).

Sound is typically composed of acoustic energy encompassing a wide range of frequencies, referred to as the frequency spectra; however, the human ear does not interpret the sound energy from each frequency as equally loud. The A-weighting filter attenuates low and high frequency energy to simulate the hearing response of the human auditory system. This weighting system has also been adopted in the evaluation of environmental sound levels and is the most widely accepted descriptor for community noise impact assessments. Sound levels that are A-weighted to reflect human response are presented as dBA in this report. An inherent property of the logarithmic decibel scale is that the sound pressure levels of two separate sources are not directly additive. For example, if a sound of 50 dBA is added to another sound of 50 dBA, the result is a 3-decibel increase (or 53 dBA), not an arithmetic doubling of 100 dBA. The human ear does not sense changes in the sound pressure level as equal changes in perceived loudness.

Scientific research demonstrates that the following general relationships hold between sound level and human perception for two broadband sound levels with the same or similar frequency characteristics:

- 1 dBA is the practically achievable limit of the accuracy of sound measurement systems and corresponds to an approximate 10 percent variation in sound pressure. A 1 dBA increase or decrease is a non-perceptible change in sound.
- 3 dBA increase or decrease is a doubling (or halving) of acoustic energy, and it corresponds to the threshold of perceptibility of change in a laboratory environment. In practice, the average person is not able to distinguish a 3 dBA difference in environmental sound outdoors.
- 5 dBA increase or decrease is described as a perceptible change in sound level and is a discernable change in an outdoor environment.
- 10 dBA increase or decrease is a tenfold increase or decrease in acoustic energy but is perceived as a doubling or halving in sound (i.e., the average person will judge a 10 dBA change in sound level to be twice or half as loud).

While the concept of sound is defined by the laws of physics, the term 'noise' has further qualities of being excessive or loud and is largely subjective. The perception of sound as noise is influenced by technical factors such as intensity, sound quality, tonality, duration, and the existing background levels. Sound can be measured, modeled, and presented in various formats, with the most common metric being the equivalent sound level (L_{eq}). The equivalent sound level has been shown to provide both an effective and uniform method for comparing time-varying sound levels and is widely used in acoustic assessments of wind energy facilities. In addition, the maximum sound level (L_{max}) can be used to quantify the maximum instantaneous sound pressure level over a given measurement period or maximum sound generated by a source.

Estimates of noise sources and the comparison to relative loudness to that of an 80 dBA garbage disposal or food processor are presented in Table 5-1. Table 5-2 provides additional reference information on acoustic terminology used throughout the wind turbine acoustic assessment.

Table 5-1. Sound Pressure Levels (L_P) and Relative Loudness of Typical Noise Sources and Acoustic Environments[1]

Noise Source or Activity	Sound Level (dBA)	Subjective Impression	Relative Loudness When Compared to 80 dBA (Garbage Disposal or Food Blender) human judgment of different sound levels
Jet aircraft takeoff from carrier (50 ft)	140	Threshold of pain	64 times as loud
50-hp siren (100 ft)	130		32 times as loud
Loud rock concert near stage Jet takeoff (200 ft)	120	Uncomfortably loud	16 times as loud
Float plane takeoff (100 ft)	110		8 times as loud
Jet takeoff (2,000 ft)	100	Very loud	4 times as loud
Heavy truck or motorcycle (25 ft)	90		2 times as loud
Garbage disposal Food blender (2 ft) Pneumatic drill (50 ft)	80	Moderately loud	Reference loudness
Vacuum cleaner (10 ft)	70		1/2 as loud
Passenger car at 65 mph (25 ft)	65		
Large store air-conditioning unit (20 ft)	60		1/4 as loud
Light auto traffic (100 ft)	50	**Quiet**	1/8 as loud
Quiet rural residential area with no activity	45		
Bedroom or quiet living room Bird calls	40	Moderately quiet	1/16 as loud
Typical wilderness area	35		
Quiet library, soft whisper (15 ft)	30	Very quiet	1/32 as loud
Wilderness with no wind or animal activity	25	Extremely quiet	1/64 as loud
High-quality recording studio	20		
Acoustic test chamber	10	Just audible	
	0	Threshold of hearing	

[1] Sources Beranek (1988) and USEPA (1971a)

Table 5-2. Acoustic Terms and Definitions

Term	Definition
Noise	Typically it is unwanted sound. This word adds the subjective response of humans to the physical phenomenon of sound. It is used only when negative effects on people are known to occur.
Sound Pressure Level (L_P)	Pressure fluctuations in a medium. Sound pressure is measured in decibels referenced to 20 microPascals, the approximate threshold of human perception to sound at 1000 Hz.
Sound Power Level (L_W)	The total acoustic power of a noise source measured in decibels referenced to 10^{-12} watts. Sound power is independent of the environment. For this reason, wind turbine manufacturer noise specifications are provided in these terms.
A-Weighted Decibel (dBA)	Environmental sound is typically composed of acoustic energy across all frequencies (Hz). To compensate for the auditory frequency response of the human ear, an A-weighting filter is commonly used for describing environmental sound levels. Sound levels that are A-weighted are presented as dBA in this report.
Unweighted Decibels (dBL)	Unweighted sound levels are referred to as linear. Linear decibels are used to determine a sound's tonality and to engineer solutions to reduce or control noise as techniques are different for low and high frequency noise. Sound levels that are linear are presented as dBL in this report.
Acoustic Modulation	Technical term describing the variation of sound pressure over time. In this report it describes the variation of sound pressure caused by aerodynamic noise as the wind turbine blade passes through air turbulence. The causes of acoustic modulation are unclear but may result from the interaction with turbulence effects created by the tower structure.
Propagation and Attenuation	Propagation is the decrease in amplitude of an acoustic signal due to geometric spreading losses with increased distance from the source. Additional sound attenuation factors include air absorption, terrain effects, sound interaction with the ground, diffraction of sound around objects and topographical features, foliage, and meteorological conditions including wind velocity, temperature, humidity and atmospheric conditions.
Octave Bands	The audible range of humans spans from 20 to 20,000 Hertz and is typically divided into octave band center frequencies (Hz) ranging from 31 to 8,000 Hz.
Broadband Noise	Noise which covers a wide range of frequencies within the audible spectrum, i.e. 200 to 2000 Hz.
Masking	Interference in the perception of one sound by the presence of another sound. At elevated wind speeds, leaf rustle and noise made by the wind itself can mask wind turbine sound levels, which remain relatively constant.
Frequency (Hz)	The rate of oscillation of a sound, measured in units of Hertz (Hz) or kilohertz (kHz). One hundred Hz is a rate of one hundred times per second. The frequency of a sound is the property perceived as pitch: a low-frequency sound (such as a bass note) oscillates at a relatively slow rate, and a high-frequency sound (such as a treble note) oscillates at a relatively high rate. For comparative purposes, the lowest note on a full range piano is approximately 32 Hz and middle C is 261 Hz.
Directivity (DI)	Directivity accounts for the variation in sound intensity with orientation relative to the noise source. Directivity is often denoted as DI.

Term	Definition
Low Frequency Noise	The frequency range of 20 to 200 Hz is typically defined as low frequency noise. At sufficiently high levels, low frequency noise can cause vibrations in structures and physiological effects in humans. Low frequency noise is generally associated with older wind turbines that have downwind rotor configurations.
Infrasound	The frequency range of infrasound is normally defined as below 20 Hz. Infrasound from wind turbines are significantly below recognized thresholds of both human perceptibility and standardized health thresholds.

Note: Compiled from multiple technical and engineering sources

5.2 Noise Regulations and Performance Standards

Tetra Tech completed a review of noise regulations at the federal, state, and county levels. The Town of Woodstock has issued noise performance standards under its Site Plan Review Ordinance. The Maine DEP regulates noise under the authority of the Site Location Development Law (38 M.R.S.A. §§ 481-490) under Chapter 375.10 entitled, *Control of Noise*.

5.2.1 Town of Woodstock Noise Performance Standards

The Town of Woodstock Site Plan Review Ordinance is effective March 28, 2005, the date of adoption at the Town Meeting. The noise performance standards (Section 18 of the Site Plan Review Ordinance) set sound level limits by land use zone and time of day and are summarized in Table 5-3. The Ordinance further states: "The maximum permissible sound pressure level of any continuous, regular or frequent or an intermittent source of sound produced by an activity shall be limited by the time period which it abuts listed below. Sound levels shall be measured at least 4 feet above the ground at the property boundary of the source."

Table 5-3. Woodstock Sound Pressure Limits Using the Equivalent of One Hour $L_{eq\ (60)}$ (dBA scale)

Receiver Land Use Zone	7 a.m. to 10 p.m.	10 p.m. to 7 a.m.
Residential	55	45
Commercial	65	55
Industrial	70	70

On November 10, 2009, the Town of Woodstock issued a formal waiver to the Project at a Planning Board Meeting effective for all project property boundaries that abut residential uses. Project property boundaries occur between parcels that are currently under agreement and parcels that are not currently under agreement. The waiver allows for sound pressure limits of 50 dBA at those Project property boundaries during nighttime hours of 10 p.m. to 7 a.m. The town concluded that the higher sound level limit would be appropriate for residential property line receptor locations because Maine DEP sound standards were met for all residential structures located on abutting properties (see Section 5.2.2). At a Planning Board meeting on January 5, 2010, the Town of Woodstock issued a site-specific, formal waiver to the Project that allows for a sound level limit of 55 dBA at all hours of the day in two areas where the

Project property boundary abuts parcel 9-8-0, as recorded in the Town of Woodstock tax records (Town of Woodstock sound level limits are shown on all figures).

An abutting property on the north side of the Project is an active timber lot with no structures, and it is subject to a permanent conservation easement that does not allow for future development. The property is actively logged, which may be considered a commercial use for noise standard purposes; therefore, the lower commercial nighttime sound level limit of 55 dBA has been applied at the property line. In addition, because the proposed location of the closest turbine (Turbine 3) does not meet DEP property line setback minimums, the Project has secured an option to acquire a setback easement (Attachment 5-1) with this property owner that would authorize the Project to: (1) locate a turbine closer to the property line than 1.5 times the maximum turbine height, (2) emit sound levels higher than local or state regulations would permit (if applicable), and (3) cast shadows or flicker on the property. If this setback easement is not executed by both parties, Turbine 3 will not be constructed and the Project would comply with the 55 dBA sound limit at the property line.

The Woodstock ordinance specifically exempts all sound generated by safety signals, warning devices, emergency pressure release valves, and other emergency activity. Noise generated by construction and temporary maintenance activities is also exempted provided it occurs between the hours of 6:30 a.m. and 8:00 p.m.

5.2.2 Maine Department of Environmental Protection Noise Control Regulations

The Maine DEP regulates noise under Chapter 375.10 of the Site Location of Development Law regulations, promulgated on November 21, 1989 and limits sound generated by new or expanded developments.

The Maine DEP noise limits are provided by land use classifications and time periods and are enforceable at the facility property boundaries and 'protected locations'. Protected locations are further defined as 'any location, accessible by foot, on a parcel of land containing a residence or planned residence or approved residential subdivision, house of worship, academic school, college, library, duly licensed hospital or nursing home near the development site at the time a Site Location of Development application is submitted' (DEP 375.10 G 14). In addition to these land uses, state parks and designated wilderness areas may also be considered protected locations in certain circumstances. Nighttime limits at a protected location apply up to 500 feet from living and sleeping quarters. At protected locations more than 500 feet from living and sleeping quarters, the daytime hourly sound level limits apply 24 hours a day. The Maine DEP regulation uses the A-weighted 1-hour L_{eq} to assess noise from stationary sound sources resulting from industrial or commercial operations. Table 5-4 presents the Maine DEP sound level limits in dBA. When routine project operations result in short duration repetitive or tonal sound which may be deemed more annoying or offensive, a 5 dBA penalty applies for purposes of assessing compliance.

Table 5-4. Maine DEP Sound Level Limits (dBA)

Location	Daytime Limit (Hourly L_{eq}) 7 a.m. to 7 p.m.	Nighttime Limit (Hourly L_{eq}) 7 p.m. to 7 a.m.
Facility Property Line	75 dBA	75 dBA
Protected Location zoned Commercial, Industrial or Transportation	70 dBA	60 dBA*
Protected Location zoned Residential, Rural or Similar Land Use	60 dBA	50 dBA*
Quiet Area – Protected Location where existing daytime sound level is 45 dBA and/or less and nighttime sound level is 35 dBA or less	55 dBA	45 dBA*
Noisy Area – Protected Location where existing daytime or nighttime sound level exceeds standard daytime and/or nighttime limits	Pre-development sound level minus 5 dBA	Pre-development sound level minus 5 dBA

* Within 500 feet of sleeping quarters, otherwise the nighttime limit is equal to the daytime limit.

Sound from routine ongoing maintenance activities is considered part of routine operation and the combined total of the ongoing maintenance and routine operation is subject to the sound level limits as shown in Table 5-4. Sound from occasional, major overhaul activities is regulated as construction activity. The Maine DEP identifies sound level limits for construction activities. Construction during daytime hours (7:00 am - 7:00 pm) is categorically exempt by Maine Statute (38 M.R.S.A. Section 484); however, sound from nighttime construction activities is subject to the nighttime routine operation sound level limits as shown in Table 5-4. Higher levels of nighttime construction sound may be allowed if permitted in advanced by the local municipality or the local municipality in conjunction with the Maine DEP, depending on the duration of the construction activity. Equipment used in construction must also comply with applicable federal noise regulations and must include environmental noise control devices in proper working condition, as originally provided with the equipment by its manufacturer.

The Maine DEP regulation and limits only apply to proposed developments within municipalities without a local quantifiable noise standard and in unorganized areas of the State. When a proposed development is located in a municipality that has duly enacted by ordinance an applicable quantifiable noise standard, which (1) contains limits that are not higher than the sound level limits contained in this regulation by more than 5 dBA, and (2) limits or addresses the various types of noises contained in the DEP regulation or all the types of noises generated by the development, the Department applies that local standard, rather than the DEP limits for each of the types of sounds the ordinance regulates (DEP 375.10 B 1). The Town of Woodstock has quantifiable numerical limits governing noise from developments that have been duly enacted by ordinance; and a waiver of the numerical limits were granted to increase the nighttime compliance level at specific sections of the project boundary. Since the Town of Woodstock regulates compliance at the project boundaries, whereas the Maine DEP standard regulates compliance 500 feet from the nearest residence, it is unclear which regulations apply and the Project has therefore chosen to demonstrate compliance for both the Maine DEP standards and the Town of Woodstock standards.

5.2.3 Summary of Acoustic Acceptance Criteria

A summary of the pertinent acoustic criteria used to assess the potential of noise impacts at existing receptors during project operation is provided below:

- The Town of Woodstock 50 dBA sound level limit at the project property boundary with residential use abutters, with the exception of a 55 dBA sound level limit in two areas where the project property boundary abuts parcel 9-8-0.
- The Maine DEP 45 dBA nighttime sound level limit for quiet areas, applicable at a maximum distance of 500 feet from a residential structure or at the real property line, if less than 500 feet.[2]
- The Maine DEP 75 dBA property line sound level limit at the project boundary if the abutting parcel is not a protected location and a more restrictive local limit does not apply.

The criteria are absolute sound level limits and are independent of the existing acoustic environment; therefore, no baseline sound survey is required to assess conformity. In addition to the abovementioned criteria, the Applicant will adhere to the U.S. Occupational Health and Safety Administration's (OSHA) regulatory limits for worker and public safety at all times during project construction and operation.

5.3 Project Noise Assessment

The following sections present the results of the project noise assessment covering sound generated during both project construction and operation. The acoustic assessment prepared by Tetra Tech considers a proposed layout consisting of 11 turbines and an alternative project layout of 10 turbines (excluding Turbine 3).

5.3.1 Construction

Development of the Project will involve construction activities to establish access roads, excavate and build wind turbine foundations, prepare the site for crane-lifting, and assemble and commission wind turbines. Work on large-scale wind energy facilities is generally divided into four phases consisting of the following:

1. Site Clearing: The initial site mobilization phase includes the establishment of temporary site offices, workshops, storage, and other on-site facilities. The site is cleared up to the work limits, and erosion and sedimentation control measures are installed as soon as possible after clearing. Initial haulage routes are prepped.
2. Excavation and Road Construction: This phase begins with the excavation and formation of access roads and preparation of laydown areas. Excavation for the concrete turbine foundations is also completed during this phase. The use of blasting is anticipated for this Project for some sections of road construction work, but will be reviewed during final geotechnical studies. A blasting report will be filed, if necessary, for any portion of project construction.
3. Foundation Work: Reinforced concrete turbine foundations are constructed and the underground electrical collection system is installed. The use of blasting is anticipated for foundation work for

[2] To ensure compliance with Maine DEP sound regulations, this study focused on the 500-foot radius around receptors, regardless of property lines.

this Project but will be reviewed during final geotechnical studies. A blasting report will be filed if necessary for any portion of project construction.

4. Wind Turbine Installation: Turbine components are delivered, installed and commissioned.

Work on these construction activities is expected to overlap. The construction of the Project may cause short-term but unavoidable noise impacts. Sound levels resulting from construction activities vary significantly depending on several factors, such as the type and age of equipment, the specific equipment manufacturer and model, the operations being performed, and the overall condition of the equipment and exhaust system mufflers. The list of construction equipment that may be used on the Project and estimates of near and far sound source levels are presented in Table 5-5.

Table 5-5. Estimated L_{max} Sound Pressure Levels from Construction Equipment

Equipment*	Estimated Sound Pressure Level at 50 feet (dBA)	Estimated Sound Pressure Level at 2,000 feet (dBA)
Crane	85	53
Forklift	80	48
Backhoe	80	48
Grader	85	53
Man basket	85	53
Dozer	83 - 88	51 - 56
Loader	83 - 88	51 - 56
Scissor Lift	85	53
Truck	84	52
Welder	73	41
Compressor	80	48
Concrete Pump	77	45

*Data compiled in part from the following sources:

Federal Highway Administration, "Roadway Construction Noise Model User's Guide," Report FHWA-HEP-05-054 / DOT-VNTSC-FHWA-05-01, January 2006.

Power Plant Construction Noise Guide, Bolt Beranek and Newman, Inc. 1977.

Federal Highway Administration, "Procedures for Abatement of Highway Traffic Noise and Construction Noise." Code of Federal Regulations, Title 23, Part 772, 1992.

The Maine DEP exempts sound generated by construction activity during daytime hours, with nighttime construction activity being held to the routine sound level limits (Table 5-4). The Town of Woodstock exempts noise generated by construction and temporary maintenance activities as long as it occurs between the hours of 6:30 a.m. and 8:00 p.m.

All reasonable efforts will be made to minimize the impact of noise resulting from construction activities. As the design of the Project progresses and construction scheduling is finalized, the construction engineer will notify the community of expected project construction commencement via public notice or alternative method. Stationary equipment and construction laydown areas will be sited as far from existing residential structures as is practical. Other possible construction noise mitigation measures include scheduling louder construction activities during daytime hours and treating internal combustion engines with appropriate-sized muffler systems to minimize excessive noise emissions.

Blasting may be required during project construction if hard rock is encountered that cannot be loosened or fractured by other means. If blasting for foundation or other noisy activities is required during the construction period, nearby residents shall be notified in advance of the scheduled activities. Blasting near buildings, structures, and other facilities susceptible to ground-borne vibration or air blast damage would be effectively planned and controlled by the contractors to mitigate the possibility of damage. To ensure compliance with the Maine DEP blast noise limits, which are provided as peak linear sound levels (dBL), a blasting plan would be developed for each blast site. The plan would include the blasting methods, surveys of existing structures and other built facilities, and distance calculations to estimate the area of potential adverse impacts. Per the Maine DEP, the maximum number of blasting events per day is 4, with blasting prohibited on Sundays and during nighttime periods (DEP 375.10 C 4).

5.3.2 Operation

Over recent years, several wind energy facilities have been constructed in the State of Maine and many more throughout the United States, and a better understanding of the generation, propagation and attenuation of wind turbine sound in the natural environment has been achieved. To assess sound generated during operation of the Spruce Mountain Wind Project, Tetra Tech conducted a comprehensive acoustic modeling analysis using wind turbine manufacturer sound data, site-specific topography data, and (CadnaA), an acoustic software modeling program that conforms to the Organization for International Standardization (ISO) Standard 9613.2 "Attenuation of Sound During Propagation Outdoors." Understanding the inherent limitations of ISO 9613.2, Tetra Tech has applied an acoustic modeling analysis that adopted appropriate conservative input assumptions that address many concerns that have been brought forth recently during the siting process of other similar ridgeline wind energy facilities. The methodology used to conduct the project sound propagation model and the results of the acoustic analysis are discussed in detail in the following sections.

5.3.2.1 Sound Propagation Model

The Spruce Mountain Wind Project would consist of up to 11 GE 1.5sle wind turbines or a combination of 9 or 10 Gamesa G87 and G90 2.0-MW wind turbines. The G87 and G90 wind turbines are comparable technologies in terms of noise emissions per manufacturer specifications. Wind turbine sound source data was obtained from Gamesa, the manufacturer of the G87 and G90 2.0-MW wind turbine. Noise emission for the proposed wind turbines has been independently tested according to the International Electrotechnical Commission (IEC) Standard IEC 61400-11, "Wind turbine generator systems – Part 11: Acoustic noise measurement techniques". Sound propagation modeling was conducted using the CadnaA software program (version 3.7.123), a comprehensive 3-dimensional acoustic modeling computer simulation software specifically developed for the power generation industry with calculations made in accordance with the ISO 9613.2 "Attenuation of Sound During Propagation Outdoors." The engineering methods specified in this standard consist of 1/1 octave band algorithms that incorporate the following:

- Geometric spreading wave divergence
- Reflection from surfaces
- Atmospheric absorption
- Screening by topography and obstacles
- Terrain complexity and ground effects
- Source directivity factors
- Height of both sources and receptors

- Seasonal foliage effects
- Meteorological conditions including the effects of wind and atmospheric inversions

The industry standard CadnaA acoustic modeling software is widely used by sound engineers due to its ability to describe very complex acoustic scenarios. CadnaA, programmed with the ISO 9613.2 standard, has been shown to be an effective and accurate acoustic modeling assessment tool for wind energy facilities. Calculation correction factors have been applied to account for inherent limitations in the ISO 9613.2 standard for specialized application of a large dimension-elevated sound source, meteorology, and the effects of complex terrain.

Each wind turbine was modeled as a point source at multiple heights extending from the bottom to the top of rotor swept area. The equivalent continuous downwind octave band sound pressure level at a receiver location is calculated for each individual wind turbine source and its image sources on both a broadband and frequency dependent basis from 31 Hz to 8 kHz. Geometrical divergence accounts for spherical spreading in the free field in accordance with the "inverse square law" using the following equation:

$$L_P = L_W + DI_\theta - 10\log\left(\frac{1}{2}\pi R^2\right) - A \text{ in dBA or dBL}$$

Where:

L_P = calculated sound pressure level at receiver location

L_W = reference sound power level by octave band center frequency

DI_θ = directivity index correction to account for the variation in sound intensity with orientation relative to the noise source

R = linear (slant) distance of L_p from source in meters (or feet multiplied by 3.28) to calculate geometrical divergence with distance

A = extraneous attenuation factors that may occur during propagation from the point sound source to the receiver

The acoustic model assumes that all wind turbines are operating continuously and concurrently at the maximum manufacturer-rated sound level at the given operational condition and sound energy is summed across all frequencies with the following equation:

$$L_{PA}(DW) = 10\log\left\{\sum_{i=1}^{n}\left[\sum_{j=1}^{9} 10^{0,1\left[L_{fT}(ij)+f(A-wtd)(j)\right]}\right]\right\}$$

Where:

n = is the number of contributions i (sources and paths)

j = is an index indicating the nine standard octave band center frequencies spanning from 31 Hz to 8 kHz

The ISO 9613.2 standard calculates received sound pressure levels for meteorological conditions favorable to propagation; i.e., downwind sound propagation or during a moderate atmospheric ground

level temperature inversion. Though a physical impracticality, the ISO 9613.2 standard simulates omnidirectional downwind propagation and worst-case wind turbine source directivity. For ground level receptor locations immediately between wind turbine positions on the ridgeline, this acoustic modeling methodology may result in an over-prediction of received sound level results. In addition, the acoustic modeling algorithms essentially assume laminar atmospheric conditions, in which neighboring layers of air do not mix but flow at different velocities. This conservative assumption does not take into consideration turbulent eddies that form when winds change speed or direction, which can interfere with the sound wave propagation path and increase attenuation effects.

Conversely, there may be anomalous meteorological conditions from time to time that are more favorable to the propagation of sound. These meteorological conditions include wind speeds increasing significantly within the low levels of the atmosphere (i.e., low-level jet stream) or strong temperature gradients (temperature inversions), commonly referred to as anomalous meteorological conditions. Temperature inversions that occur at 100 meters or lower generate effects that are uniform in all directions from the source, whereas strong wind gradients will affect receptors primarily in the upwind and downwind directions. There is insufficient data to accurately determine the prevalence of such anomalous meteorological conditions at the project site. Temperature inversions are most commonly caused by radiative cooling during the evening and night on cloudless nights with calm or very low-level winds speeds. These conditions are not conducive to wind turbine operation as wind speeds must be above cut-in wind speeds, roughly 4 to 5 m/s (9-11 mph). Therefore, the effect of temperature inversions on wind turbine sound propagation is typically of little concern.

During low-level jet streams, it has been shown that the classical theory of spherical wave propagation may not hold at very large distances from a sound source. The presence of such anomalous meteorological conditions can cause sound rays to curve downward back towards the ground, where they are then reflected upwards towards the gradient. This process then repeats, leading to a trapped sound wave. This wave refraction effect results in the convergence of modified cylindrical wave spreading that has a reduced rate of sound attenuation, which may influence receivers located immediately downwind of sound sources. While the Maine DEP does not specifically require or suggest that these meteorological conditions be explicitly addressed in modeling assessments, ISO 9613-2 includes a methodology to account for effects produced under these conditions and so they were addressed in this assessment. Though expected to be somewhat infrequent, operational sound levels resulting from anomalous meteorological conditions were considered in the modeling analysis approach to ensure a conservative acoustic assessment. At short to medium range distances and for elevated sound sources such as a wind turbine, the effects of anomalous meteorological conditions on sound propagation are relatively minor.

In addition to geometrical divergence, attenuation factors include topographical features, terrain coverage, and/or other natural or anthropogenic obstacles that can affect sound attenuation and result in acoustical screening. Topographical information was imported into the acoustic model using the official United States Geological Survey (USGS) digital elevation dataset to accurately represent terrain in three dimensions. Consideration of topography and terrain is important for both sound propagation and the acoustic environment. Terrain conditions, vegetation type, ground cover, and the density and height of foliage can also influence the absorption that takes place when sound waves travel over land. The ISO 9613.2 standard accounts for ground absorption rates by assigning a numerical coefficient of 0 for acoustically hard, reflective surfaces and 1 for absorptive surfaces and soft ground. If the ground is

pavement or hard-packed dirt, typically found in industrial complexes, or for sound traveling over bodies of water, the absorption coefficient is defined as G=0 to account for reduced sound attenuation. In contrast, ground covered in snow (common in this region during the winter season), vegetation (including suburban lawns), livestock and agricultural fields (both fallow with bare soil and planted with crops), will be acoustically absorptive and aid in sound attenuation, i.e., G=1.0. For the acoustic modeling analysis, a conservative ground absorption rate was selected, accounting for a semi-reflective ground surface. Additional sound attenuation through foliage and diffraction around and over existing anthropogenic structures was disregarded for all modeling scenarios. The results are therefore representative of worst-case scenario: a snow-covered, defoliate winter landscape.

5.3.2.2 Analysis Results

Acoustic modeling for the proposed project layout was completed for wind turbine cut-in and full rotational operating conditions under standard atmospheric conditions (Figures 5-1 and 5-2, respectively) and also included an assessment for full rotational operating conditions under anomalous meteorological conditions (Figure 5-3). These analyses describe received sound levels over the range of future operational conditions. The acoustic modeling analysis consisted of calculating received sound levels at receptors with a summary of unique number identifiers, Universal Transverse Mercator (UTM) coordinates, and received sound levels provided in Table 5-6. The results of the acoustic modeling analysis were compared to the 45 dBA nighttime sound level limit imposed by the Maine DEP at all abutting and nearby residences. In addition, sound limits at certain residential property boundaries near the Project were evaluated to determine compliance with sound level limits imposed by the Town of Woodstock (Figure 5-1).

Sound contour plots displaying project operational sound levels in color-coded sound level ranges are provided in Figures 5-1, 5-2 and 5-3. Figure 5-1 presents broadband (dBA) operational sound levels under low-level wind speeds that are slightly higher than initial cut-in wind speeds for the wind turbines. Figure 5-2 shows broadband (dBA) operational sound levels at wind speeds necessary to sustain wind turbine operation at maximum rotational speeds. Figure 5-3 presents broadband (dBA) operational sound levels at maximum rotational wind speed and anomalous meteorological conditions (reduced sound attenuation over extended distances). The acoustic modeling analysis was completed for all 11 wind turbines operating at the same time. Figure 5-4 presents received sound levels at full rotational operating conditions under anomalous meteorological conditions for a 10 wind-turbine layout, where Turbine 3 is not constructed. This decision is pending final acceptance of the setback easement by the abutting landowner.

The resultant sound contour plots are independent of the existing acoustic environment, i.e., the plots represent project-generated sound levels only.

Table 5-6. Summary of Spruce Mountain Wind Turbine Acoustic Model Output at Receptors (dBA)

Receptor ID	UTM Coordinates (m)		LAT/LON (degrees, minutes, seconds)		Highest Sound Level Within 500 Feet of a Receptor at Cut-In Rotation (dBA)	Highest Sound Level Within 500 Feet of a Receptor at Maximum Rotation (dBA)*
	Easting	Northing	Latitude	Longitude		
1	377,928	4,919,830	44° 25' 17.30" N	70° 32' 0.54" W	23	39
2	378,076	4,919,730	44° 25' 14.15" N	70° 31' 53.74" W	23	39
3	378,119	4,919,740	44° 25' 14.49" N	70° 31' 51.83" W	23	39
4	378,032	4,919,741	44° 25' 14.46" N	70° 31' 55.76" W	23	39
5	378,139	4,919,743	44° 25' 14.61" N	70° 31' 50.91" W	23	39
6	378,003	4,919,752	44° 25' 14.81" N	70° 31' 57.07" W	23	39
7	377,652	4,920,260	44° 25' 31.04" N	70° 32' 13.36" W	22	38
8	377,510	4,919,923	44° 25' 20.05" N	70° 32' 19.51" W	25	40
9	377,593	4,920,069	44° 25' 24.82" N	70° 32' 15.89" W	23	39
10	377,336	4,920,174	44° 25' 28.08" N	70° 32' 27.58" W	25	41
11	377,309	4,919,808	44° 25' 16.20" N	70° 32' 28.49" W	26	42
12	376,993	4,919,545	44° 25' 7.48" N	70° 32' 42.56" W	29	44
13	377,864	4,920,027	44° 25' 23.65" N	70° 32' 3.59" W	23	39
14	377,830	4,919,975	44° 25' 21.94" N	70° 32' 5.08" W	23	39
15	378,022	4,920,404	44° 25' 35.94" N	70° 31' 56.77" W	23	39
16	378,145	4,920,342	44° 25' 34.03" N	70° 31' 51.13" W	23	39
17	377,579	4,920,348	44° 25' 33.86" N	70° 32' 16.76" W	22	38
18	377,627	4,920,061	44° 25' 24.60" N	70° 32' 14.35" W	23	39
19	378,098	4,919,738	44° 25' 14.41" N	70° 31' 52.77" W	23	39
20	377,708	4,920,284	44° 25' 31.87" N	70° 32' 10.85" W	22	38
21	377,902	4,919,961	44° 25' 21.53" N	70° 32' 1.79" W	23	39
22	377,869	4,920,104	44° 25' 26.15" N	70° 32' 3.44" W	23	39

* Sound levels at maximum rotation are shown for anomalous meteorological conditions, where sound attenuation is reduced over extended distances.

SPRUCE MOUNTAIN WIND, LLC
SPRUCE MOUNTAIN WIND PROJECT
OXFORD COUNTY, MAINE

FIGURE 5-1
GAMESA G90 - 2.0 MW
RECEIVED SOUND LEVELS:
WTGS AT CUT-IN ROTATION

JANUARY 2010

PATRIOT RENEWABLES
Spruce Mountain Wind, LLC

Legend

- Turbine Location (based on 10-26-09 layout)
- Receptor
- Maine DEP limit of 45 dBA up to 500 feet from a residence

Town of Woodstock dBA Limits at Project Property Boundaries

- Commercial Use: 55dBA
- Residential Use: 50dBA (by waiver)
- Residential Use: 55dBA (by waiver)

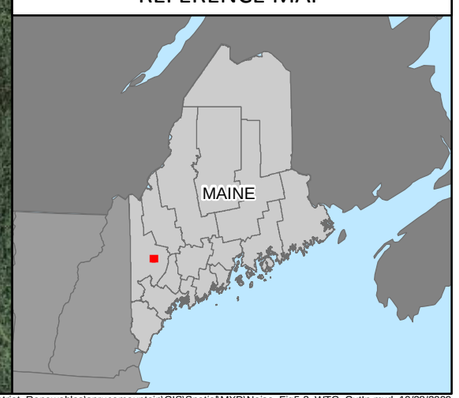
Sound Level Ranges (dBA)

- 30 - 35
- 35 - 40
- 40 - 45
- 45 - 50

0 0.125 0.25 0.5 Miles

TETRA TECH EC, INC.

REFERENCE MAP



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SPRUCE MOUNTAIN WIND, LLC
SPRUCE MOUNTAIN WIND PROJECT
OXFORD COUNTY, MAINE

FIGURE 5-2
GAMESA G90 - 2.0 MW
RECEIVED SOUND LEVELS:
WTGS AT MAXIMUM ROTATION

JANUARY 2010

PATRIOT RENEWABLES
Spruce Mountain Wind, LLC

Legend

- Turbine Location (based on 10-26-09 layout)
- Receptor
- Maine DEP limit of 45 dBA up to 500 feet from a residence

Town of Woodstock dBA Limits at Project Property Boundaries

- Commercial Use: 55dBA
- Residential Use: 50dBA (by waiver)
- Residential Use: 55dBA (by waiver)

Sound Level Ranges (dBA)

- 30 - 35
- 35 - 40
- 40 - 45
- 45 - 50
- >50
- 55 dBA Isopleth

0 0.125 0.25 0.5 Miles

TETRA TECH EC, INC.

REFERENCE MAP

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SPRUCE MOUNTAIN WIND, LLC
SPRUCE MOUNTAIN WIND PROJECT
OXFORD COUNTY, MAINE

FIGURE 5-3
GAMESA G90 - 2.0 MW
RECEIVED SOUND LEVELS:
TURBINES AT MAXIMUM ROTATION
ANOMALOUS METEOROLOGICAL CONDITIONS

JANUARY 2010

PATRIOT RENEWABLES
Spruce Mountain Wind, LLC

Legend

- Turbine Location (based on 10-26-09 layout)
- Receptor
- Maine DEP limit of 45 dBA up to 500 feet from a residence

Town of Woodstock dBA Limits at Project Property Boundaries

- Commercial Use: 55dBA
- Residential Use: 50dBA (by waiver)
- Residential Use: 55dBA (by waiver)

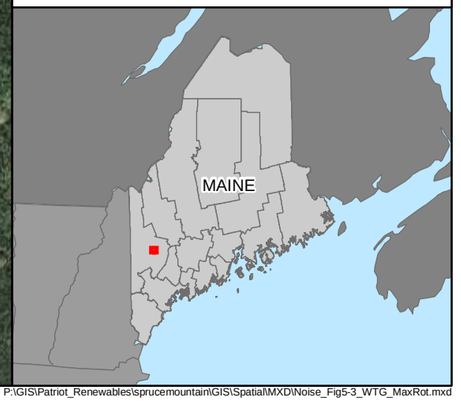
Sound Level Ranges (dBA)

- 30 - 35
- 35 - 40
- 40 - 45
- 45 - 50
- >50
- 55 dBA Isopleth

0 0.125 0.25 0.5 Miles

TETRA TECH EC, INC.

REFERENCE MAP



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SPRUCE MOUNTAIN WIND, LLC
SPRUCE MOUNTAIN WIND PROJECT
OXFORD COUNTY, MAINE

FIGURE 5-4
GAMESA G90 - 2.0 MW
RECEIVED SOUND LEVELS:
TURBINES AT MAXIMUM ROTATION
ANOMALOUS METEOROLOGICAL CONDITIONS
ALTERNATE PROJECT LAYOUT:
TURBINE 3 NOT CONSTRUCTED

JANUARY 2010

PATRIOT RENEWABLES
Spruce Mountain Wind, LLC

Legend

- Turbine Location (based on 10-26-09 layout)
- Receptor
- Maine DEP limit of 45 dBA up to 500 feet from a residence

Town of Woodstock dBA Limits at Project Property Boundaries

- Commercial Use: 55dBA
- Residential Use: 50dBA (by waiver)
- Residential Use: 55dBA (by waiver)

Sound Level Ranges (dBA)

- 30 - 35
- 35 - 40
- 40 - 45
- 45 - 50
- >50
- 55 dBA Isopleth

0 0.125 0.25 0.5 Miles

TETRA TECH EC, INC.

REFERENCE MAP

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TODD.GYS(ECIBOSDGYST) P:\GIS\Patriot_Renewables\sprucemountain\GIS\Spatial\MXD\Noise_Fig5-4_WTG_MaxRot_No_WTG3.mxd

5.3.2.3 Short Duration Repetitive Sound

The Maine DEP defines Short Duration Repetitive Sounds (SDRS) as "a sequence of repetitive sounds which occur more than once within an hour, each clearly discernible as an event and causing an increase in sound level of at least 6 dBA on the fast meter response above the sound level observed immediately before and after the event, each typically less than ten seconds in duration, and which are inherent to the process or operation of the development and are foreseeable." SDRS events are typically less than 10 seconds in duration and occur more than once within an hour. When routine operations are shown to produce SDRS or tonal sound, a 5 dBA penalty is added to the observed 1-hour L_{eq} sound levels, for the purposes of determining compliance status. Furthermore, maximum L_{max} sound level limits for SDRS are a 55 dBA nighttime not-to-exceed limit for protected locations in an area where existing use is not predominantly commercial, transportation, or industrial. At protected locations in an area where existing use is predominantly commercial, transportation, or industrial the maximum L_{max} nighttime sound level limit is 65 dBA.

A recent published study by the United Kingdom Department for Trade and Industry (DTI), which investigated sound levels at several operating wind energy facilities, was reviewed by Tetra Tech.[3] This extensive study concluded that there was no evidence that infrasound emitted by wind turbines were at levels to be of concern for adverse health effects, though a condition referred to as acoustic amplitude modulation was identified in isolated situations. The study states that "the dominant character of the combined aerodynamic noise as described above is therefore a 'swish', which is familiar to most people who have stood near to a large wind turbine. Blade swish is not completely steady, but is modulated (fluctuates) at the rate at which the blades pass a fixed point, i.e. there is a cycle of increased and then reduced level which occurs typically at the blade passing frequency of around once per second." A second study, commissioned by England's University of Salford[4] to further investigate this phenomenon, confirmed that the instances of acoustic amplitude modulation were in fact quite low.

Therefore, we do not expect the Project to fall into the SDRS category, as defined by Maine DEP.

5.3.2.4 Tonal Sound

Wind turbine sound is produced by air interacting with the turbine blades, which tends to produce broadband sound energy in the 200 Hz to 2000 Hz frequency range. Noise from a modern wind turbine with an upwind rotor design is generally broad-spectrum, absent of tonal qualities. A sound is considered to be tonal if acoustic energy is concentrated in a narrow frequency range. For the purpose of the Maine DEP regulation, a tonal sound exists if, at a protected location, the one-third octave band sound pressure level in the band containing the tonal sound exceeds the arithmetic average of the sound pressure levels of the two contiguous one-third octave bands by the following amounts:

- 5 dB for such one-third octave band with a center frequency from 500 Hz to 10,000 Hz, inclusive.
- 8 dB for such one-third octave band with a center frequency from 160 Hz to 400 Hz, inclusive.

[3] ETSU, "The Assessment and Rating of Noise from Wind Farms", The Working Group on Noise from Wind Turbines, ETSU Report for the DTI, ETSU-R-97, September 1996.
Hayes, M (2006), "The Measurement of Low Frequency Noise at Three UK Wind Farms", Contract Number W/45/00656/00/00, URN 06/1412.
[4] University of Salford (2007), "Research into Aerodynamic Modulation of Wind Turbine Noise: Final Report", URN 07/1235, dated July 2007.

- 15 dB for such one-third octave band with a center frequency from 25 Hz to 125 Hz, inclusive.

A review of source frequency data for the Gamesa G90 2.0-MW wind turbines was completed with the manufacturer source spectrums from 50 Hz to 10,000 Hz and is presented in dBL in column 'B' of Table 5-7. The spectra presented must be interpreted as an approximation and not as a prediction of the spectral noise distribution produced by the wind turbine. In order to assess compliance with the ANSI tonal provision, the arithmetic average of the two adjacent 1/3 octave band center frequencies was calculated, with the result shown in column 'C'. To assess compliance with the ANSI tonal provision, the net difference between the source and two adjacent octave bands is calculated in column 'B-C' and compared to the applicable ANSI thresholds for the maximum differential for that frequency range provided in column 'D'. As shown in Table 5-7, the candidate wind turbines do not generate sound with prominent discrete tones, with a maximum octave band differential of less than 2 dBL. Tonality is typically assessed at the receiver location; however, a sound source spectrum that shows minimal tonality greatly reduces the likelihood of tonal conditions at any discrete receiver location.

Table 5-7. Tonality Determination with Maine DEP Threshold for a Representative Gamesa Source Spectrum

1/3 Octave Band Center Frequency (Hz) Column 'A'	Representative Gamesa Source Spectrum (dBL) Column 'B'	Arithmetic Average of Two Adjacent Frequencies (dBL) Column 'C'	Calculated Net Differential (dBL) Column 'B – C'	ANSI Tonal Criteria Limit (dBL) Column 'D'
25	108.4	-	-	-
31	106.2	106.4	<0	15
40	104.6	104.6	0.0	15
50	103.0	103.1	<0	15
63	101.7	101.8	<0	15
80	100.6	100.5	0.1	15
100	99.3	99.4	<0	15
125	98.2	98.4	<0	15
160	97.8	97.7	0.1	8
200	97.0	97.0	0.0	8
250	96.1	96.2	<0	8
315	95.6	95.2	0.4	8
400	93.9	94.3	<0	8
500	93.5	93.2	0.3	5
630	92.3	92.2	0.1	5
800	90.8	90.8	0.0	5
1000	89.2	89.1	0.1	5
1250	87.3	87.3	<0	5
1600	85.5	85.4	0.1	5
2000	83.4	83.3	0.1	5
2500	80.9	80.9	0.0	5
3150	78.4	78.0	0.4	5
4000	74.7	74.7	<0	5
5000	71.1	70.9	0.2	5
6300	67.0	66.9	0.1	5
8000	62.7	61.0	1.7	5
10000	53.3	-	-	-

5.4 Conclusions

The overall conclusions of the acoustic assessment are as follows:

Construction and blasting impacts have been assessed and found to be acceptable. A more detailed blasting plan will be prepared once extents of blasting are determined.

Acoustic modeling results demonstrate that the Project would operate in compliance with the Town of Woodstock Noise Performance Standards and the State of Maine DEP noise limits for wind power projects at all residential receptor locations. The overall impact of the Project at project property boundaries is expected to be minimal given the topography, shape of the parcels, and heavily-wooded terrain.

The proposed wind turbine models will not produce an audible steady-state pure tone or apparent tonal conditions at any existing receptors, as defined by the Maine DEP definition for the determination of prominent discrete tones. Sound levels at receptors are also not expected to result in regularly-occurring SDRS.

Operation of the Project may result in periodically audible sound at receptor locations under certain operational and meteorological conditions. These conditions may occur when background sound levels are low, and wind speeds are high enough for wind turbine operation on the ridgeline. Residents outside their houses at receptor locations and with a direct line of sight to an operating wind turbine may hear a gentle swooshing sound characteristic of wind energy facilities. While the turbines will be audible under these conditions, they will still be within applicable regulatory sound limits. At more distant receptor locations during meteorological conditions favorable to sound propagation and very quiet background ambient sound conditions, wind turbines may be periodically audible but will remain well within all applicable regulatory limits. Project sound levels will be consistent with sound generated by wind energy facilities in the State of Maine and throughout the continental United States that have been successfully sited by employing similar noise criteria.

PATRIOT RENEWABLES
Spruce Mountain Wind, LLC

Attachment 5-1
The Nature Conservancy Setback Easement

OPTION TO ACQUIRE EASEMENT

This Agreement is dated Nov 4, 2009 (the "Effective Date"), by and between **THE NATURE CONSERVANCY** (**"GRANTOR"**), a not for profit corporation organized and existing under the laws of the District of Columbia, whose address is c/o The Nature Conservancy Maine Chapter, 14 Maine Street, Suite 401, Brunswick, ME 04011, and **SPRUCE MOUNTAIN WIND, LLC,** a Massachusetts limited liability company with a mailing address at 549 South Street, Quincy, MA 02169 (**"GRANTEE"**).

Whereas GRANTEE is developing a wind energy project on Spruce Mountain in Woodstock, Maine (the "Wind Power Project") that abuts land owned by GRANTOR in the town of Woodstock, Maine recorded as Map 13, Lot 4 in the Town of Woodstock assessors' maps, and as more particularly described in **Exhibit A** attached hereto (hereinafter referred to as the " THE PROPERTY").

In consideration of the payment of and the covenants, conditions and obligations to be observed and performed by GRANTEE set forth in this agreement, GRANTOR and GRANTEE agree as follows:

1. GRANT OF OPTION. GRANTOR hereby grants to GRANTEE an option (the "Option"), for the period and upon and subject to the terms and conditions contained in this Agreement, to acquire a setback easement in Woodstock, Maine, set forth on **Exhibit B** for the purpose of (a) the right to place turbines nearer than 1.5 times the turbine height from the boundary of THE PROPERTY, (b) the right to cast shadows or shadow flicker from the Wind Power Project onto THE PROPERTY, (c) the right to have sound generated from the wind turbine generators impact THE PROPERTY an d exceed otherwise applicable state or local maximum sound level at the boundary of THE PROPERTY ("the Easement").

2. OPTION TERM. The term of the Option shall be for a period commencing on the Effective Date (the Date this Option to Acquire Easement is signed by the GRANTOR) and expiring 3 years from the Effective Date (the "Option Term"). If GRANTEE fails to exercise the Option within the Option Term, which exercise shall be by written notice in the manner set forth hereafter, GRANTEE's right in the option shall be null, void, and of no further force and effect, and this Agreement shall expire.

3. GRANTOR'S DUE DILIGENCE. The GRANTOR shall have a period commencing on the Effective Date and expiring six (6) months from the Effective Date to conduct its due diligence ("Grantor's Due Diligence Period") regarding the impact that the activities contemplated by GRANTEE may have on GRANTOR's abutting property, on the surrounding eco-system and GRANTOR's overall mission. If upon conducting such due diligence the

GRANTOR determines that the activities contemplated by GRANTEE to be contrary to the GRANTOR's objectives for the abutting property and eco-system and inconsistent with GRANTOR's mission, then, prior to the expiration of the Due Diligence period, GRANTOR shall provide written notice to GRANTEE that this Option to Acquire Easement is terminated. All payments made by GRANTEE shall be immediately refunded and all obligations and rights of the parties shall cease, and this Option to Acquire Easement shall be void without recourse to the parties.

In the event the GRANTOR determines that the contemplated activities have no adverse impact on the GRANTOR's interests, the GRANTOR shall notify GRANTEE in writing and upon receipt of such notification GRANTEE shall make a payment of an Additional Option Consideration in the amount of

4. EASEMENT ACQUISITION PRICE. At Closing, GRANTEE agrees to pay to the GRANTOR the "Easement Acquisition Price" of

All amounts due to GRANTOR hereunder shall be disbursed and payable in accordance with written instructions from GRANTOR no less than five (5) days prior to the Closing date.

5. OPTION EXERCISE. The Option shall be exercised by delivering written notice from GRANTEE to GRANTOR, before the expiration of the Option Term ("Exercise Notice") but not prior to the expiration of the Grantor's Due Diligence period, that affirmatively states that the GRANTEE exercises the Option without condition or qualification. Upon delivery of the Exercise Notice, GRANTEE shall become obligated to acquire and GRANTOR shall become obligated to grant the Easement pursuant to the terms of this Agreement and the Easement. Within thirty (30) business days after exercise of the Option, GRANTEE shall pay to GRANTOR the Easement Acquisition Price, in immediately available funds, and the parties shall execute and deliver the Setback Easement at a closing (the "Closing") at a location in the State of Maine designated by GRANTOR.

6. AUTHORITY. The persons executing this Agreement hereby warrant and represent that they each have the authority to bind their respective corporations to its terms, have been duly authorized by their respective corporations to do so, and have full corporate authority to perform the obligations contemplated by this Agreement. Each party shall, upon request of the other party, provide such other evidence of authority as may be reasonably required by the requesting party. GRANTOR warrants that THE PROPERTY is not encumbered by a mortgage or other lien or encumbrance that would in any way impair this Option or the Easement, or, if THE PROPERTY is so encumbered, GRANTOR agrees to obtain all subordinations, partial releases, or other recordable evidence necessary so that GRANTEE's interest in this Option and, if exercised, the Easement is not impair or subject to divestment.

7. MEMORANDUM OF OPTION. Recording of this Agreement is prohibited except as allowed in this paragraph. GRANTOR, upon determination of no adverse impact and the expiration of the Grantor's Due Diligence Period, will deliver to GRANTEE a memorandum of option substantially in the form of **Exhibit C** which may be recorded by GRANTEE.

8. MISCELLANEOUS.(a) Execution by Both Parties. This Agreement shall not become effective and binding until fully executed by both GRANTEE and GRANTOR. This Agreement may be executed in any number of counterparts, each of which shall be deemed an original and all of which shall constitute one and the same instrument.

(b) Notice. All notices, claims, certificates, requests, demands and other communications required or permitted to be delivered hereunder shall be in writing and shall be deemed to have been duly given if delivered personally or mailed by overnight, registered or certified mail, postage prepaid, return receipt requested, at the following addresses or to such other address as the person to whom notice is to be given may have previously furnished to the other in writing in the manner set forth above.: (i) if to GRANTOR: The Nature Conservancy, c/o The Nature Conservancy Maine Chapter, 14 Maine Street, Suite 401, Brunswick, ME 04011; and (ii) if to GRANTEE: Spruce Mountain Wind, LLC, 549 South Street, Quincy, MA 02169. GRANTEE, its successors and assigns shall keep GRANTOR advised of its current mailing address and the representative of GRANTEE who will handle inquiries and notifications.

(c) Governing Law. This Agreement shall be governed by and construed in accordance with the laws of the State of Maine without regard to conflicts of law principles.

(d) Successors and Assigns. This Agreement shall apply to, inure to the benefit of and be binding upon and enforceable against the parties hereto and their respective heirs, successors, and or assigns, to the extent as if specified at length throughout this Agreement. GRANTEE may assign this at any time.

(e) Time. Time is of the essence under this Agreement.

(f) Cost of this Agreement. Any cost and/or fees incurred by the GRANTEE or GRANTOR in preparing and executing this Agreement shall be borne by the respective party incurring such cost and/or fee, other than as provided herein.

(g) Entire Agreement. This Agreement contains all of the terms, promises, covenants, conditions and representations made or entered into by or between GRANTOR and GRANTEE and supersedes all prior discussions and agreements whether written or oral between GRANTOR and GRANTEE with respect to the Option and all other matters contained herein and constitutes the sole and entire agreement between GRANTOR and GRANTEE with respect thereto. This Agreement may not be modified or amended unless such amendment is set forth in writing and

executed by both GRANTOR and GRANTEE with the formalities hereof.

IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be executed as of Nov 4, 2009.

Witness:

THE NATURE CONSERVANCY

By: _____

William Brune

Its: Director of Land Protection

_____

SPRUCE MOUNTAIN WIND, LLC

By: _____

Its: Manager - Member

_____

EXHIBIT A

The Property

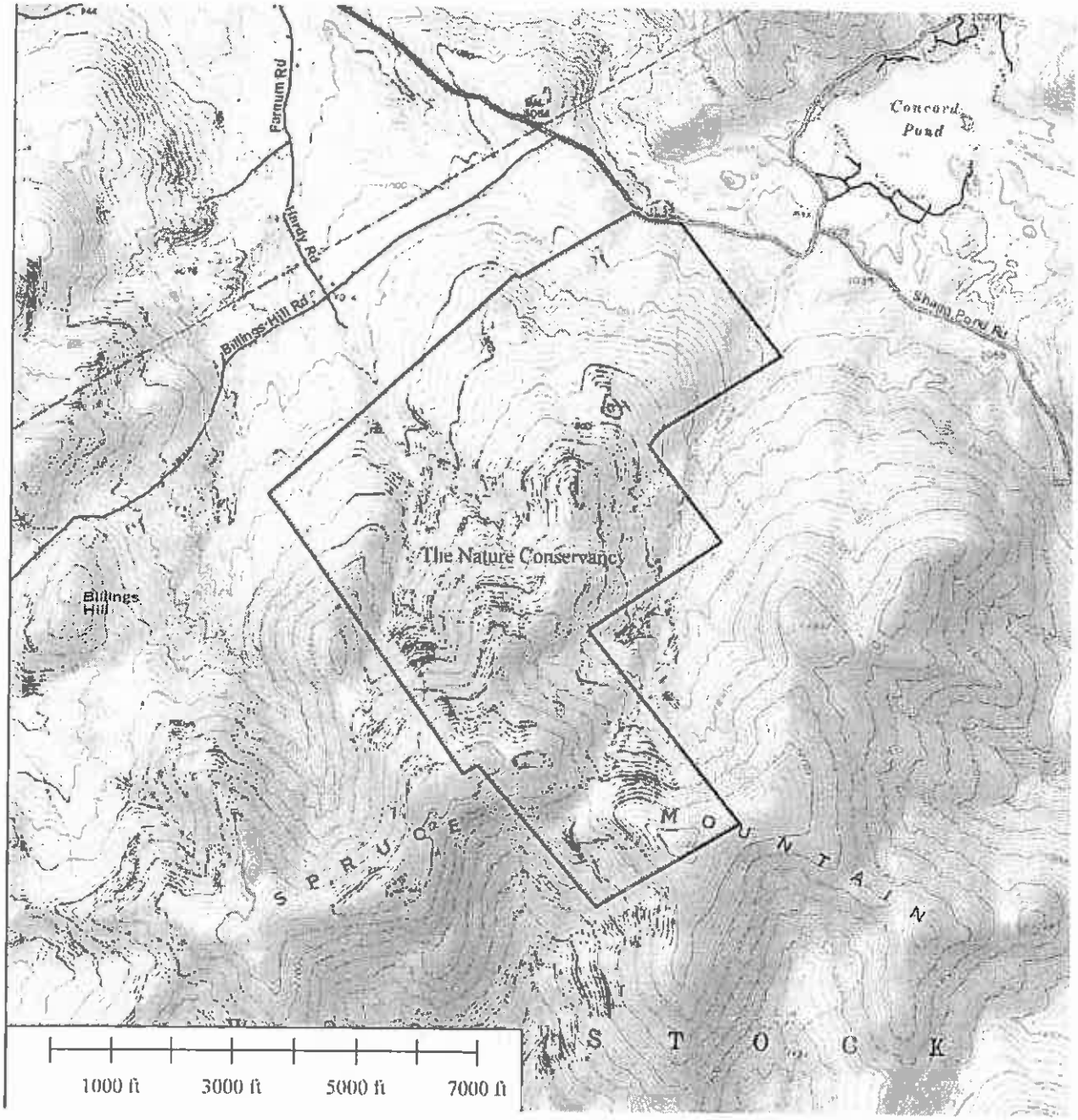

EXHIBIT B

Easement

This easement is made by **The Nature Conservancy** ("GRANTOR"), the owner of a certain lot or parcel of land situated in the Town of Woodstock, County of Oxford, and State of Maine, more particularly described in the town of Woodstock Assessors maps as Map 13, Lot 4 (hereinafter referred to as the " THE PROPERTY").

Whereas, **Spruce Mountain Wind, LLC**, a Massachusetts limited liability company having a mailing address at 549 South St., Quincy, MA 02169 ("GRANTEE"), plans to construct and operate a wind power project, including wind turbine generators and towers and related equipment, facilities, infrastructure and substructures (hereinafter referred to as the "Wind Power Project"), on lands adjacent to THE PROPERTY; and

Whereas, the Wind Power Project will have wind turbine generators within 600 feet of the boundaries of THE PROPERTY, and the State of Maine DEP requires 1.5 times the turbine blade height setback from the property boundary unless an easement is granted; and

Whereas, the Wind Power Project will emit sound, possibly at levels that may exceed applicable state or local maximum sound level limits, and may cast shadows onto or produce a shadow flicker effect on THE PROPERTY;

Now, therefore, for good and valuable consideration received, GRANTOR hereby grants, with quitclaim covenant, a perpetual easement to GRANTEE for: (a) the right to place turbines nearer than 1.5 times the turbine height from the boundary of THE PROPERTY, (b) the right to cast shadows or shadow flicker from the Wind Power Project onto THE PROPERTY, (c) the right to have sound generated from the wind turbine generators impact THE PROPERTY and exceed otherwise applicable state or local maximum sound level at the boundary of THE PROPERTY.

This easement shall extend to, be binding upon and shall inure to the benefit of heirs, personal representatives, successors and assigns of the parties hereto. The burden of the easement hereby granted shall run with THE PROPERTY. The benefit of the easement hereby granted is appurtenant to GRANTEE's adjacent property, but shall be transferable in whole or in part, and may be sold, leased, assigned, pledged, and mortgaged by GRANTEE, it being the intent of the parties that such benefit may be transferred to any successors or assignees of GRANTEE that own or operate the Wind Power Project, as it may be modified, divided or expanded.

The benefit of the easement hereby granted may be enforced by GRANTEE, its successors and assigns, by any appropriate legal or equitable remedy. In the event that GRANTEE, its successors or assigns, shall bring an action against GRANTOR, its successors or assigns, by reason of a breach or violation of this Easement by GRANTOR, its successors and assigns, the substantially prevailing party in such action shall be entitled to recover their reasonable attorneys' fees and court costs incurred in such action from the substantially non-prevailing party.

Grantor
The Nature Conservancy

By: _____
Date: _____
Address:
_____
_____

Grantee
Spruce Mountain Wind, LLC

By: Jay Cashman
Date: _____
Address:
549 South Street
Quincy, MA 02169

STATE OF MAINE

_____, SS.

On this ___ day of _____ , 2009, before me, the undersigned notary public, personally appeared _____, as _____ of _____ [corporation], proved to me through satisfactory evidence of identification, which was a Maine drivers license, to be the person whose name is signed on the preceding or attached document, and acknowledged to me that he/she signed it voluntarily for its stated purpose as _____ of [said corporation].

_____
Notary Public
My Commission Expires:

COMMONWEALTH OF MASSACHUSETTS

_____, SS.

On this ___ day of _____, 2009, before me, the undersigned notary public, personally appeared _____, as _ _____ of _____ [corporation], proved to me through satisfactory evidence of identification, which was a Massachusetts drivers license, to be the person whose name is signed on the preceding or attached document, and acknowledged to me that he/she signed it voluntarily for its stated purpose as _____ of said [corporation].

_____
Notary Public
My Commission Expires:

EXHIBIT C

Memorandum of Option

Optionor:	**The Nature Conservancy**
Optionee:	**Spruce Mountain Wind, LLC**
Premises:	Setback easement affecting lands of Optionor in Woodstock, Maine recorded as Map 13, Lot 4 in the Woodstock Assessors' Maps, and as more particularly described on Schedule A attached hereto.
Date of Option:	_____, 2009
Term of Option:	_____, 2009

In witness whereof, The Nature Conservancy has hereunto caused this instrument to be signed and sealed by the undersigned duly authorized this _____ day of _____, 2009.

Witness:

THE NATURE CONSERVANCY

By: _____

_____

Its: _____

By:_____

STATE OF MAINE
Oxford County

_____, 2009

Personally appeared the above named _____, in his capacity as _____ _____of The Nature Conservancy and acknowledged before me the foregoing instrument to be his free act and deed in his said capacity and the free act and deed of said company.

_____
Notary Public

_____
Print or type name as signed

Schedule A to Exhibit C